wound, so that the diseased limbs become quite conspicuous. These wounds produce an effect similar to girdling, and where many limbs are attacked the effect on a tree is disastrous.

In preliminary work on the disease certain large dark-colored spores were continually found, but they were supposed to come from some saprophyte not worthy of attention. In cultures made from diseased bark this form, together with another, continually appeared. Finally both forms were separated and transferred to bean stems in test tubes. In the one case the familiar dark spores were produced, while in the other the sporophores of *Schizophyllum commune* were formed.

Inoculations were made with both forms on apple seedlings in the nursery and on limbs of an apple tree. In two weeks' time it was found that in every case inoculations made from the fungus with dark spores had taken effect, while the *Schizophyllum* had in no instance made any growth. The wounds made in the bark of check trees healed over at once. More inoculations were now made and the results have been the same. At this date, October 9th, several of the seedlings are nearly girdled with wounds three to four inches in length. The inoculations on the limbs of apple trees have made an equally satisfactory growth, laying bare the wood and producing the dead, sunken areas of bark characteristic of the disease.

When it was found that the fungus with the dark spores was parasitic, diligent search was made for the spores on diseased bark, but none were to be found. This was in the fore part of July. Further search throughout the summer failed to reveal any of the spores.

On September 11th Mr. F. C. Stewart, Botanist of this Station, examined the test-tube cultures and at once noted the strong resemblance of the dark spores to those of the black rot of the apple, *Sphæropsis malorum*, Peck. Mature apples were at once inoculated with material from the test tubes. In twenty-four hours decay had begun around points of inoculation, and in 16 days pycindia and mature spores of *Sphæropsis* were found on all inoculated apples. The check apples which were punctured but not inoculated remained sound. Further search for the dark spores on diseased bark revealed pycnidia just beneath the epidermis containing the mature brown spores and immature ones still attached. All characters were identical with *Sphæropsis* on the fruit. These same pycnidia were subsequently found on bark of the nursery stock and apple-tree limbs where the inoculations were made. Pure cultures of *Sphæropsis malorum* from apples make the same growth on bean stems and bear fruit in exactly the same manner as the first cultures from which the inoculations were made.

While it seems reasonably certain that this canker of the apple is caused by a well-known fungus in a hitherto unrecognized rôle, the result of a set of experiments now under way is awaited to complete the chain of evidence. Seedlings placed in the greenhouse have been inoculated with pure cultures of *Sphæropsis malorum* taken from affected apples. If these inoculations produce the so-called canker the identity of the disease will be established.

W. Paddock.

WAMPUM BELTS.

To the Editor of Science: Thanks for the kind notice of my article on wampum by my esteemed friend, Dr. Brinton. I wish, however, to correct the word 'acknowledges,' as it seems to imply that I believe in the early use of council wampum, a belief against which I have argued for years. In a very mild way I stated that 'it is very doubtful whether wampum belts were used before the coming of the whites as necessary or ordinary parts of Indian councils.' I thought quill belts might have been used, as in the Onondaga tradition of Hiawatha. Because of the great rarity of shell beads on early sites in New York and Canada, I thought 'a mistake has been made regarding Cartier's account of Hochelagan beads in 1535.' But one shell bead has been found at Hochelaga, and there is a corresponding rarity on early Mohawk and Onondaga sites. Quoting another I said, "My own experience is the same, Prehistoric Onondaga sites yield few shell articles or none at all."

I have examined as many wampum belts and as much council wampum as most men, and my conclusion is precisely that of Dr. Brinton.

"All known to me are later than the discovery, and none have been found in ancient burials." He is fully sustained by facts in his historic doubt 'that wampum belts were made by the prehistoric Indians.' When the New York bulletins on archæology reach the use of shell articles, I hope, should I prepare that paper, to show this in detail. The material is in hand, but not yet arranged. Meanwhile it is certain that the early interior inhabitants of New York knew little of shell beads at all.

W. M. BEAUCHAMP.

SCIENTIFIC LITERATURE.

Practical Plant Physiology; an Introduction to Original Research for Students and Teachers of Natural Science, Medicine, Agriculture and Forestry. By DR. W. DETMER, Professor of Botany in the University of Jena. Translated from the second German edition by S. A. MOOR, M. A. (Camb.), F. L. S., Principal of the Girasia College, Gondal, Kathiawad, India. With one hundred and eighty-four illustrations. New York, The Macmillan Co.; London, Swan, Sonnenschein & Co. 1898. 8vo. Pp. xix + 555. Price, $3.00.

The laboratory method of study finds variable application in the several departments of botany, but in none is it so typically and profitably serviceable as in the domain of physiology. The strong chemical and physical bias which pervades the subject permits almost every vital operation of the plant to be brought under control by chemical or physical methods. As changes and movements in plants are usually slow, the greatest delicacy of method and apparatus is often required to secure intelligible results. In consequence of these facts the laboratory part of instruction in vegetable physiology is destined to become varied and extensive, and to take form slowly.

It is to the credit of Dr. Detmer, of Jena, that he presented to the botanical public the first manual in any language for the guidance of the student in vegetable physiology. It was a work of over 350 pages, issued in 1888, and although at the time it was said by some of his colleagues not adequately to represent the current state of the science, yet time has shown that for an initial work it was exceptionally well achieved, and that to produce a more representative and serviceable volume has been a task that few have since attempted. After a decade the work has passed into a second edition, so much changed and amplified as to almost constitute it a new book, but retaining the characteristics that have made its predecessor so acceptable to many instructors and students.

Although a French edition appeared in 1890, no English version has been prepared until the present time. That it has now been made available to the English-speaking student will be welcome information to many instructors who have heretofore made less use of the work than desired. It is gratifying to find that the translation has been well done, and that it adequately expresses not only the facts of the volume, but the sense of the author's personal interest, which lends a charm to both German and English versions. An unusual feature of the translation is the rendering of the whole volume without addition or alteration. This is, in some respects, a good method, as one receives from the hands of the translator the unsophisticated result of the author's labor, but when it extends to the translation of an appendix giving the places in Germany where apparatus may be obtained, it seems as if the substitution of names of firms in the countries where the book is expected to be used would have been a meritorious deviation.

The outline of the work embraces the food of plants, the molecular forces in plants, metabolic processes, movements of growth and movements of irritation. It contains but little matter not truly a part of physiology, according to strict interpretation of the term. The two hundred experiments, or, more properly speaking, studies, into which the work is divided, cover a great variety of topics and are drawn largely from the memoirs of the most distinguished investigators. But it is to the labors of the author in testing, modifying and adapting the experiments to the condition of pedagogical requirement that give them much of their value in this connection.

It would be easy to find fault with some parts of the work. The first experiments given in the book, those of water cultures, are likely to prove discouraging to the beginner, as they re-